

Appendix L Glossary

L-1. Abbreviations and Acronyms

1D	One Dimensional
2D	Two-dimensional
2DRMS	Twice the distance root mean square
3D	Three-dimensional
A-E	Architect-Engineer
A/E/C.....	Architect/Engineer/Construction
ACSM.....	American Congress on Surveying and Mapping
ADA	Air Defense Artillery
AFB	Air Force Base
ALTA	American Land Title Association
AM/FM.....	Automated Mapping/ Facility Mapping
AOC	Aircraft Obstruction Surveys
ARP	Antenna Reference Point
ASCE.....	American Society of Civil Engineers
ASPRS.....	American Society for Photogrammetry and Remote Sensing
BFE.....	Base Flood Elevation
BLM	Bureau of Land Management
BS	Backsight
CADD.....	Computer Aided Drafting and Design
CAiCE	Computer Aided Civil Engineering
CALTRANS	California Department of Transportation
CEFMS.....	Corps of Engineers Financial Management System
COGO.....	Coordinate Geometry
CONUS.	CONtinental United States
CORPSCON	CORPS CONvert
CORS	Continuously Operating Reference Stations
COR.....	Contracting Officer's Representative
DA	Department of the Army
DE.....	Difference in Elevation
DEM	Digital Elevation Model
DOD	Department of Defense
DOT.....	Department of Transportation
DFARS.	Defense Federal Acquisition Regulation Supplement
DGPS.....	Differential Global Positioning System
DTM	Digital Terrain Model
EAC	Echelons Above Corps
EDM	Electronic Distance Measurement
EFARS.....	Engineer Federal Acquisition Regulation Supplement
EM.....	Engineer Manual
ERM	Elevation Reference Mark
ERDC	Engineer Research and Development Center
E&D.	Engineering and Design
FA.....	Field Artillery
FAA	Federal Aviation Administration
FAC	Florida Administrative Code

FAR	Federal Acquisition Regulations
FAR	Federal Aviation Regulation
FEMA	Federal Emergency Management Agency
FFP	Firm Fixed Price
FGCS	Federal Geodetic Control Subcommittee
FGDC	Federal Geographic Data Committee
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FLSA	Fair Labor Standards Act
FM	Field Manual
FMSFIE	Facility Management Standard for Facilities, Infrastructure, and Environment
FOA	Field Operating Activity
FS	Foresight
G&A	General and Administrative
GDOP	Geometric Dilution of Position
GIS	Geographic Information System
GPS	Global Positioning System
GRS 80	Geodetic Reference System of 1980
GS	General Support
GSA	General Services Administration
GZD	Grid Zone Designator
HARN	High Accuracy Regional Networks
HI	Height of Instrument
HDOP	Horizontal Dilution of Position
HPGN	High Precision Geodetic Networks
HR	Height of Reflector
HT	Height of Target
HTRW	Hazardous, Toxic, or radioactive Waste
HQUSACE	Headquarters, US Army Corps of Engineers
IDC	Indefinite Delivery Contract
IERS	International Earth Rotation Service
IGE	Independent Government Estimate
IGLD 55	International Great Lakes Datum of 1955
IGLD 85	International Great Lakes Datum of 1985
ILS	Instrument Landing System
INT	Intersection
ITL	Information Technology Lab
ITRF	International Terrestrial Reference Frame
JTR	Joint Travel Regulation
KO	Contracting Officer
LCC	Lambert Conformal Conic
LEC	Linear Error of Closure
LIDAR	LIght Detection And Ranging
LWRP	Low Water Reference Plane
MACOM	Major Army Command
MDL	MicroStation Design Language
MGRS	Military Grid-Reference System
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLRS	Multiple Launch Rocket System
MLS	Microwave Landing System

MSL.....	Mean Sea Level
MSL1912.....	Mean Sea Level Datum of 1912
NAD 27	North American Datum of 1927
NAD 83	North American Datum of 1983
NADCON	North American Datum Conversion
NAS	National Airspace System
NAVAID	Navigation Aid
NAVD 88	North American Vertical Datum 1988
NDGPS	Nationwide Differential GPS
NFIP	National Flood Insurance Program
NGRS	National Geodetic Reference System
NGS	National Geodetic Survey
NGVD 29	National Geodetic Vertical Datum 1929
NMAS	National Map Accuracy Standard
NMP	National Mapping Program
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NSRS	National Spatial Reference System
NSSDA.....	National Standard for Spatial Data Accuracy
NVCN.....	National Vertical Control Network
OCONUS	Outside the Continental United States
OHWM.....	Ordinary High Water Mark
OPUS.....	On-Line Positioning User Service
OTF	On-the-Fly
P&S	Plans and Specifications
PADS.....	Position and Azimuth Determination System
PBM	Permanent Benchmark
PDOP.....	Position Dilution of Position
PDSC	Professional Development Support Center
PI	Point of Intersection
PLGR.....	Precise Lightweight Geodetic Receiver
PM	Project Manager or Management
POB	Point of Beginning
POI	Point on Line
POT	Point of Tangency
PPRTK	Post-Processed Real-Time Kinematic
ppm.....	Parts per Million
PR&C	Purchase Request & Commitment
PRIP	Plant Replacement and Improvement Program
PROSPECT	Proponent Sponsored Engineer Corps Training
PVT	Point of Vertical Tangent
QA	Quality Assurance
QC	Quality Control
RFP	Request for Proposal
RMS	Root mean Square
RMSE	Root Mean Square Error
RTK.....	Real Time Kinematic
SCP	Survey Control Point
SDSFIE.....	Spatial Data Standard for Facilities, Infrastructure, and Environment
SDTS	Spatial Data Transfer Standard
SI	International System of Units

SOW	Scope or Statement of Work
SPCE	Survey Planning and Coordination Element
SPCS	State Plane Coordinate System
TA.....	Target Acquisition
TBM	Temporary Benchmark
TDS	Tripod Data Systems
TDSE.....	Touchdown Zone Elevation
TEC	Topographic Engineering Center
TIN	Triangular Irregular Network
TM.....	Transverse Mercator
TGO.....	Trimble Geomatics Office
TP	Turning Point
TSC.....	Trimble Survey Controller
US.....	United States
USACE	US Army Corps of Engineers
USARC.....	US Army Reserve Center
USC&GS	US Coast & Geodetic Survey
USCG	US Coast Guard
USFS	US Forest Service
USGS.....	US Geological Survey
USNAVOCEANO.....	US Navy Oceanographic Office
USNG	US National Grid
UTM	Universal Transverse Mercator
VDOP	Vertical Dilution of Position
VERTCON	VERTical CONversion
VLBI.....	Very-Long-Baseline-Interferometry
WAAS	Wide Area Augmentation System
WGS 84	World Geodetic System of 1984
WRDA.....	Water Resources Development Act
XREF.....	External Reference
ZD.....	Zenith Distance

L-2. Terms

Absolute or Autonomous GPS

Operation with a single receiver for a desired position. This receiver may be positioned to be stationary over a point. This mode of positioning is the most common military and civil application.

Accuracy

The degree to which an estimated (mean) value is compatible with an expected value. Accuracy implies the estimated value is unbiased.

Adjustment

Adjustment is the process of estimation and minimization of deviations between measurements and a mathematical model.

Altimeter

An instrument that measures elevation differences usually based on atmospheric pressure measurements.

Altitude

The vertical angle between the horizontal plane of the observer and a directional line to the object.

Angle of Depression

A negative altitude.

Angle of Elevation

A positive altitude.

Angular Misclosure

Difference in the actual and theoretical sum of a series of angles.

Archiving

Storing of documents and information.

Astronomical Latitude

Angle between the plumb line and the plane of celestial equator. Also defined as the angle between the plane of the horizon and the axis of rotation of the earth. Astronomical latitude applies only to positions on the earth and is reckoned from the astronomic equator, north and south through 90E. Astronomical latitude is the latitude that results directly from observations of celestial bodies, uncorrected for deflection of the vertical.

Astronomical Longitude

Arbitrarily chosen angle between the plane of the celestial meridian and the plane of an initial meridian. Astronomical longitude is the longitude that results directly from observations on celestial bodies, uncorrected for deflection of the vertical.

Astronomical Triangle

A spherical triangle formed by arcs of great circles connecting the celestial pole, the zenith and a celestial body. The angles of the astronomical triangles are: at the pole, the hour angle; at the celestial body, the parallactic angle; at the zenith, the azimuth angle. The sides are: pole to zenith, the co-latitude; zenith to celestial body, the zenith distance; and celestial body to pole, the polar distance.

Atmospheric Refraction

Refraction of electromagnetic radiation through the atmosphere causing the line-of-sight to deviate from a straight path. Mainly temperature and pressure conditions determine the magnitude and direction of curvature affecting the path of light from a source. Refraction causes the ray to follow a curved path normal the surface gradient.

Azimuth

The horizontal direction of a line clockwise from a reference plane, usually the meridian. Often called forward azimuth to differentiate from back azimuth.

Azimuth Angle

The angle less than 180° between the plane of the celestial meridian and the vertical plane with the observed object, reckoned from the direction of the elevated pole. In astronomic work, the azimuth angle is the spherical angle at the zenith in the astronomical triangle, which is composed of the pole, the zenith and the star. In geodetic work, it is the horizontal angle between the celestial pole and the observed terrestrial object.

Azimuth Closure

Difference in arc-seconds of the measured or adjusted azimuth value with the true or published azimuth value.

Backsight

A sight on a previously established traverse or triangulation station and not the closing sight on the traverse. A reading on a rod held on a point whose elevation has been previously determined.

Barometric Leveling

Determining differences of elevation from measured differences of atmospheric pressure observed with a barometer. If the elevation of one station above a datum is known, the approximate elevations of other station can be determined by barometric leveling. Barometric leveling is widely used in reconnaissance and exploratory surveys.

Baseline

Resultant three-dimensional vector between any two stations with respect to a given coordinate system. The primary reference line in a construction system.

Base net

The primary baseline used for densification of survey stations to form a network.

Base Points

The beginning points for a traverse that will be used in triangulation or trilateration.

Base Control

The horizontal and vertical control points and coordinates used to establish a base network. Base control is determined by field surveys and permanently marked or monumented for further surveys.

Bearing

The direction of a line with respect to the meridian described by degrees, minutes, and seconds within a quadrant of the circle. Bearings are measured clockwise or counterclockwise from north or south, depending on the quadrant.

Benchmark

A permanent material object, natural or artificial, on a marked point of known elevation.

Best Fit

To represent a given set of points by a smooth function, curve, or surface which minimizes the deviations of the fit.

Bipod

A two-legged support structure for an instrument or survey signal at a height convenient for the observer.

Bluebook

Another term for the "FGCS Input Formats and Specifications of the National Geodetic Data Base".

Blunder

A mistake or gross error.

Bureau International de l'Heure

The Bureau was founded in 1919 and its offices since then have been at the Paris Observatory. By an action of the International Astronomical Union, the BIH ceased to exist on 1 January 1988 and a new organization, the International Earth Rotation Service (IERS) was formed to deal with determination of the Earth's rotation.

Cadastral Survey

Relates to land boundaries and subdivisions, and creates units suitable for transfer or to define the limitations of title. The term cadastral survey is now used to designate the surveys of the public lands of the US, including retracement surveys for identification and resurveys for the restoration of property lines; the term can also be applied properly to corresponding surveys outside the public lands, although such surveys are usually termed land surveys through preference.

Calibration

Determining the systematic errors in an instrument by comparing measurements with correct values. The correct value is established either by definition or by measurement with a device that has itself been calibrated or of much higher precision.

Cartesian Coordinates

A system with its origin at the center of the earth and the x and y and z axes in the plane of the equator. Typically, the x-axis passes through the meridian of Greenwich, and the z-axis coincides with the earth's axis of rotation. The three axes are mutually orthogonal and form a right-handed system.

Cartesian System

A coordinate system consisting of axes intersecting at a common point (origin). The coordinate of a point is the orthogonal distance between that point and the hyperplane determined by all axes. A Cartesian coordinate system has all the axes intersecting at right angles, and the system is called a rectangular.

Celestial Equator

A great circle on the celestial sphere with equidistant points from the celestial poles. The plane of the earth's equator, if extended, would coincide with that of the celestial equator.

Celestial pole

A reference point at the point of intersection of an indefinite extension of the earth's axis of rotation and the apparent celestial sphere.

Celestial sphere

An imaginary sphere of infinite radius with the earth as a center. It rotates from east to west on a prolongation of the earth's axis.

Central Meridian

A line of constant longitude at the center of a graticule. The central meridian is used as a base for constructing the other lines of the graticule. The meridian is used as the y-axis in computing tables for a State Plane Coordinate system. That line, on a graticule, which represents a meridian and which is an axis of symmetry.

Chain

Equal to 66 feet or 100 links. The unit of length prescribed by law for the survey of the US public lands. One acre equals 10 square chains.

Chained Traverse

Observations and measurements performed with tape.

Chaining

Measuring distances on the ground with a graduated tape or with a chain.

Chart Datum

Reference surface for soundings on a nautical chart. It is usually taken to correspond to a low water elevation, and its depression below mean sea level is represented by the symbol Z_o . Since 1989, chart datum has been implemented to mean lower low water for all marine waters of the US its territories, Commonwealth of Puerto Rico and Trust Territory of the Pacific Islands.

Chi-square Testing

Non-parametric statistical test used to classify the shape of the distribution of the data.

Chronometer

A portable timekeeper with compensated balance, capable of showing time with extreme precision and accuracy.

Circle Position

A prescribed setting (reading) of the horizontal circle of a direction theodolite, to be used for the observation on the initial station of a series of stations that are to be observed.

Circuit Closure

Difference between measured or adjusted value and the true or published value.

Clarke 1866 Ellipsoid

The reference ellipsoid used for the NAD 27 horizontal datum. It is a non-geocentric ellipsoid formerly used for mapping in North America.

Closed Traverse

Starts and ends at the same point or at stations whose positions have been determined by other surveys.

Collimation

A physical alignment of a survey target or antenna over a mark or to a reference line.

Collimation Error

The angle between the actual line of sight through an optical instrument and an alignment.

Compass Rule

The correction applied to the departure (or latitude) of any course in a traverse has the same ratio to the total misclosure in departure (or latitude) as the length of the course has to the total length of the traverse.

Confidence Level

Statistical probability (in percent) based on the standard deviation or standard error associated with the normal probability density function. The confidence level is assigned according to an expansion factor multiplied by the magnitude of one standard error. The expansion factor is based on values found in probability tables at a chosen level of significance.

Conformal

Map projection that preserves shape.

Contour

An imaginary line on the ground with all points at the same elevation above or below a specified reference surface.

Control

Data used in geodesy and cartography to determine the positions and elevations of points on the earth's surface or on a cartographic representation of that surface. A collective term for a system of marks or objects on the earth or on a map or a photograph whose positions or elevation are determined.

Control Densification

Addition of control throughout a region or network.

Control Monuments

Existing local control or benchmarks that may consist of any Federal, state, local or private agency points.

Control Point

A point with assigned coordinates is sometimes used as a synonym for control station. However, a control point need not be realized by a marker on the ground.

Control Survey

A survey which provides coordinates (horizontal or vertical) of points to which supplementary surveys are adjusted.

Control Traverse

A survey traverse made to establish control.

Conventional Terrestrial Pole (CTP)

The origin of the WGS 84 Cartesian system is the earth's center of mass. The Z-axis is parallel to the direction of the CTP for polar motion, as defined by the Bureau of International de l'Heure (BIH), and equal to the rotation axis of the WGS 84 ellipsoid. The X-axis is the intersection of the WGS 84 reference meridian plane and the CTP's equator, the reference meridian being parallel to the zero meridian defined by the BIH and equal to the X-axis of the WGS 84 ellipsoid. The Y-axis completes a right-handed, earth-centered, earth-fixed orthogonal coordinate system, measured in the plane of the CTP equator 90 degrees east of the X-axis and equal to the Y-axis of the WGS 84 ellipsoid.

Coordinate Transformation

A mathematical process for obtaining a modified set of coordinates through some combination of rotation of coordinate axes at their point of origin, change of scale along coordinate axes, or translation through space

CORPSCON

(Corps Convert) Software package (based on NADCON) capable of performing coordinate transformations between NAD 83 and NAD 27 datums.

Crandall Method

Traverse misclosure in azimuth or angle is first distributed in equal portions to all the measured angles. The adjusted angles are then held fixed and all remaining coordinate corrections distributed among the distance measurements.

Cross sections

A survey line run perpendicular to the alignment of a project, channel or structure.

Curvature

The rate at which a curve deviates from a straight line. The parametric vector described by dt/ds , where t is the vector tangent to a curve and s is the distance along that curve.

Datum

Any numerical or geometrical quantity or set of such quantities which serve as a reference or base for other quantities.

Declination

The angle, at the center of the celestial sphere, between the plane of the celestial equator and a line from the center to the point of interest (on a celestial body).

Deflection of the Vertical

The spatial angular difference between the upward direction of a plumb line and the normal to the reference ellipsoid. Often expressed in two orthogonal components in the meridian and the prime vertical directions.

Deflection Traverse

Direction of each course measured as an angle from the direction of the preceding course.

Deformation Monitoring

Observing the movement and condition of structures by describing and modeling its change in shape.

Departure

The orthogonal projection of a line onto an east-west axis of reference. The departure of a line is the difference of the meridional distances or longitudes of the ends of the line.

Differential GPS

Process of measuring the differences in coordinates between two receiver points, each of which is simultaneously observing/measuring satellite code ranges and/or carrier phases from the NAVSTAR GPS constellation. Relative positioning with GPS can be performed by a static or kinematic modes.

Differential Leveling

The process of measuring the difference of elevation between any two points by spirit leveling.

Direction

The angle between a line or plane and an arbitrarily chosen reference line or plane. At a triangulation station, observed horizontal angles are referred to a common reference line and termed horizontal direction. A line, real or imaginary, pointing away from some specified point or locality toward another point. Direction has two meanings: that of a numerical value and that of a pointing line.

Direct Leveling

The determination of differences of elevation through a continuous series of short horizontal lines. Vertical distances from these lines to adjacent ground marks are determined by direct observations on graduated rods with a leveling instrument equipped with a spirit level.

Distance Angle

An angle in a triangle opposite a side used as a base in the solution of the triangle, or a side whose length is to be computed.

Dumpy Level

The telescope permanently attached to the leveling base, either rigidly to by a hinge that can be manipulated by a micrometer screw.

Earth-Centered Ellipsoid

Center at the Earth's center of mass and minor semi-axis coincident with the Earth's axis of rotation.

Easting

The distance eastward (positive) or westward (negative) of a point from a particular meridian taken as reference.

Eccentricity

The ratio of the distance from the center of an ellipse to its focus on the major semi-axis.

Electronic Distance Measurement (EDM)

Timing or phase comparison of electro-magnetic signal to determine an interferometric distance.

Elevation

The height of an object above some reference datum.

Ellipsoid

Formed by revolving an ellipse about its minor semi-axis. The most commonly used reference ellipsoids in North America are: Clarke 1866, Geodetic Reference System of 1980 (GRS 80), World Geodetic System of 1972 (WGS 72) and World Geodetic System of 1984 (WGS 84).

Ellipsoid height

The magnitude h of a point above or below the reference ellipsoid measured along the normal to the ellipsoid surface.

Error

The difference between the measured value of a quantity and the theoretical or defined value of that quantity.

Error Ellipse

An elliptically shaped region with dimensions corresponding to a certain probability at a given confidence level.

Error of Closure

Difference in the measured and predicted value of the circuit along the perimeter of a geometric figure.

Finite Element Method

Obtaining an approximate solution to a problem for which the governing differential equations and boundary conditions are known. The method divides the region of interest into numerous, interconnected sub-regions (finite elements) over which simple, approximating functions are used to represent the unknown quantities.

Fixed Elevation

Adopted as a result of tide observations or previous adjustment of spirit leveling, and which is held at its accepted value in any subsequent adjustment.

Foresight

An observation to the next instrument station. The reading on a rod that is held at a point whose elevation is to be determined.

Frequency

The number of complete cycles per second existing in any form of wave motion.

Geodesic Line

Shortest distance between any two points on any mathematically defined surface.

Geodesy

Determination of the time-varying size and figure of the earth by such direct measurements as triangulation, leveling and gravimetric observations.

Geodetic Control

Established and adjusted horizontal and/or vertical control in which the shape and size of the earth have been considered in position computations.

Geodetic Coordinates

Angular latitudinal and longitudinal coordinates defined with respect to a reference ellipsoid.

Geodetic Height

See Ellipsoid height.

Geodetic Latitude

The angle which the normal at a point on the reference ellipsoid makes with the plane of the equator.

Geodetic Leveling

The observation of the differences in elevation by means of a continuous series of short horizontal lines of sight.

Geodetic Longitude

The angle subtended at the pole between the plane of the geodetic meridian and the plane of a reference meridian (Greenwich).

Geodetic North

Direction tangent to a meridian pointing toward the pole defining astronomic north, also called true north.

Geodetic Reference System of 1980

Reference ellipsoid used to establish the NAD 83 system of geodetic coordinates.

Geoid

An equipotential surface of the gravity field approximating the earth's surface and corresponding with mean sea level in the oceans and its extension through the continents.

GPS (Global Positioning System)

DoD satellite constellation providing range, time, and position information through a GPS receiver system.

Gravimeter

Instrument for measuring changes in gravity between two points.

Gravity

Combined acceleration potential of an object due to gravitation and centrifugal forces.

Greenwich Meridian

The astronomic meridian through the center of the Airy transit instrument of the Greenwich Observatory, Greenwich, England. By international agreement in 1884, the Greenwich meridian was adopted as the meridian from which all longitudes, worldwide, would be calculated.

Grid Azimuth

The angle in the plane of projection between a straight line and the line (y-axis) in a plane rectangular coordinate system representing the central meridian. While essentially a map-related quantity, a grid azimuth may, by mathematical processes, be transformed into a survey-related or ground-related quantity.

Grid Inverse

The computation of length and azimuth from coordinates on a grid.

Grid Meridian

Line parallel to the line representing the central meridian or y-axis of a grid on a map. The map line parallel to the line representing the y-axis or central meridian in a rectangular coordinate system.

Gunter's Chain

A measuring device once used in land surveying. It was composed of 100 metallic links fastened together with rings. The total length of the chain is 66 feet. Also called a four-pole chain.

Gyrotheodolite

A gyroscopic device used to measure azimuth that is built-in or attached to a theodolite.

Histogram

A graphical representation of relative frequency of an outcome partitioned by class interval. The frequency of occurrence is indicated by the height of a rectangle whose base is proportional to the class interval.

Horizontal Control

Determines horizontal positions with respect to parallels and meridians or to other lines of reference.

Hour Circle

Any great circle on the celestial sphere whose plane is perpendicular to the plane of the celestial equator.

Index Error

A systematic error caused by deviation of an index mark or zero mark on an instrument having a scale or vernier, so that the instrument gives a non-zero reading when it should give a reading of zero. The distance error from the foot of a leveling rod to the nominal origin (theoretical zero) of the scale.

Indirect Leveling

The determination of differences of elevation from vertical angles and horizontal distances.

Interior Angle

An angle between adjacent sides of a closed figure and lying on the inside of the figure. The three angles within a triangle are interior angles.

International Foot

Defined by the ratio 30.48/100 meters.

International System of Units (SI)

A self-consistent system of units adopted by the general Conference on Weights and Measures in 1960 as a modification of the then-existing metric system.

Interpolation Method

Determination of a intermediate value between given values using a known or assumed rate of change of the values between the given values.

Intersection

Determining the horizontal position of a point by observations from two or more points of known position. Thus measuring directions or distances that intersect at the station being located. A station whose horizontal position is located by intersection is known as an intersection station.

Intervisibility

When two stations are visible to each other in a survey net.

Invar

An alloy of iron containing nickel, and small amounts of chromium to increase hardness, manganese to facilitate drawing, and carbon to raise the elastic limit, and having a very low coefficient of thermal expansion (about 1/25 that of steel).

Isogonic Chart

A system of isogonic lines, each for a different value of the magnetic declination.

Isogonic Line

A line drawn on a chart or map and connecting all points representing points on the earth having equal magnetic declination at a given time.

Laplace Azimuth

A geodetic azimuth derived from an astronomic azimuth by use of the Laplace equation.

Laplace Condition

Arises from the fact that a deflection of the vertical in the plane of the prime vertical will give a difference between astronomic and geodetic longitude and between astronomic and geodetic azimuth. Conversely, the observed differences between astronomic and geodetic values of the longitude and of the azimuth may both be used to determine the deflection in the plane of the prime vertical.

Laplace Equation

Expresses the relationship between astronomic and geodetic azimuths in terms of astronomic and geodetic longitudes and geodetic latitude.

Laplace Station

A triangulation or traverse station at which a Laplace azimuth is determined. At a Laplace station both astronomic longitude and astronomic azimuth are determined.

Least Count

The finest reading that can be made directly (without estimation) from a vernier or micrometer.

Least Squares Adjustment

The adjustment of the values of either the measured angles or the measured distances in a traverse using the condition that the sum of the squares of the residuals is a minimum.

Level

Any device sensitive to the direction of gravity and used to indicate directions perpendicular to that of gravity at a point.

Level Datum

A level surface to which elevations are referred. The generally adopted level datum for leveling in the US is mean sea level. For local surveys, an arbitrary level datum is often adopted and defined in terms of an assumed elevation for some physical mark.

Level Net

Lines of spirit leveling connected together to form a system of loops or circuits extending over an area.

Line of Sight

The line extending from an instrument along which distant objects are seen, when viewed with a telescope or other sighting device.

Local Coordinate System

Where the coordinate system origin is assigned arbitrary values and is within the region being surveyed and used principally for points within that region.

Local Datum

Defines a coordinate system that is used only over a region of very limited extent.

Loop Traverse

A closed traverse that starts and ends at the same station. A pattern of measurements in the field, so that the final measurement is made at the same place as the first measurement.

Magnetic Bearing

The angle with respect to magnetic north or magnetic south stated as east or west of the magnetic meridian.

Magnetic Meridian

The vertical plane through the magnetic pole including the direction, at any point, of the horizontal component of the Earth's magnetic field.

Major Semi-Axis

The line from the center of an ellipse to the extremity of the longest diameter. The term is also used to mean the length of the line.

Map

A conventional representation, usually on a plane surface and at an established scale, of the physical features (natural, artificial, or both) of a part or whole of the Earth's surface by means of signs and symbols and with the means of orientation indicated.

Map Accuracy

The accuracy with which a map represents. Three types of error commonly occur on maps: errors of representation, which occur because conventional signs must be used to represent natural or man-made features such as forests, buildings and cities; errors of identification, which occur because a non-existent feature is shown or is misidentified; and errors of position, which occur when an object is shown in the wrong position. Errors of position are commonly classified into two types: errors of horizontal location and errors of elevation. A third type, often neglected, is errors of orientation.

Map Scale

The ratio of a specified distance on a map to the corresponding distance in the mapped object.

Mean Angle

Average value of the angles.

Mean Lower Low Water (MLLW)

The average height of all lower low waters recorded over a 19-year period.

Mean Sea Level Datum

Adopted as a standard datum for heights or elevations. The Sea Level Datum of 1929, the current standard for geodetic leveling in the United States, is based on tidal observations over a number of years at various tide stations along the coasts.

Metric Unit

Belonging to or derived from the SI system of units.

Micrometer

In general, any instrument for measuring small distances very accurately. In astronomy and geodesy, a device, for attachment to a telescope or microscope, consisting of a mark moved across the field of view by a screw connected to a graduated drum and vernier. If the mark is a hair-like filament, the micrometer is called a filar micrometer.

Minor Semi-Axis

The line from the center of an ellipse to the extremity of the shortest diameter. I.e., one of the two shortest lines from the center to the ellipse. The term is also used to mean the length of the line.

Misclosure

The difference between a computed and measured value.

Monument

A physical object used as an indication of the position on the ground of a survey station.

NADCON

The National Geodetic Survey developed the conversion program NADCON (North American Datum Conversion) to convert to and from North American Datum of 1983. The technique used is based on a bi-harmonic equation classically used to model plate deflections. NADCON works exclusively in geographical coordinates (latitude/longitude).

Nadir

The point directly beneath the instrument and directly opposite to the zenith or the lowest point.

National Geodetic Vertical Datum 1929

Formerly adopted as the standard geodetic datum for heights, based on an adjustment holding 26 primary tide stations in North America fixed.

National Map Accuracy Standards

Specifications of the accuracy required of topographic maps published by the US at various scales.

National Tidal Datum Epoch

A period of 19 years adopted by the National Ocean Survey as the period over which observations of tides are to be taken and reduced to average values for tidal datums.

Network

Interconnected system of surveyed points.

Non-SI units

Units of measurement not associated with International System of Units (SI).

North American Datum of 1927

Formerly adopted as the standard geodetic datum for horizontal positioning. Based on the Clarke ellipsoid of 1866, the geodetic positions of this system are derived from a readjustment of survey observations throughout North America.

North American Datum of 1983

Adopted as the standard geodetic datum for horizontal positioning. Based on the Geodetic Reference System of 1980, the geodetic positions of this system are derived from a readjustment of survey observations throughout North America.

North American Vertical Datum of 1988

Adopted as the standard geodetic datum for heights.

Northing

A linear distance, in the coordinate system of a map grid, northwards from the east-west line through the origin (or false origin).

Open Traverse

Begins from a station of known or adopted position, but does not end upon such a station.

Optical Micrometer

Consists of a prism or lens placed in the path of light entering a telescope and rotatable, by means of a graduated linkage, about a horizontal axis perpendicular to the optical axis of the telescope axis. Also called an optical-mechanical compensator. The device is usually placed in front of the objective of a telescope, but may be placed immediately after it. The parallel-plate optical micrometer is the form usually found in leveling instruments.

Optical Plummet

A small telescope having a 90° bend in its optical axis and attached to an instrument in such a way that the line of sight proceeds horizontally from the eyepiece to a point on the vertical axis of the instrument and from that point vertically downwards. In use, the observer, looking into the plummet, brings a point on the instrument vertically above a specified point (usually a geodetic or other mark) below it.

Order of Accuracy

Defines the general accuracy of the measurements made in a survey. The order of accuracy of surveys are divided into four classes labeled: First Order, Second Order, Third Order and Fourth or lower order.

Origin

That point in a coordinate system which has defined initial coordinates and not coordinates determined by measurement. This point is usually given the coordinates (0,0) in a coordinate system in the plane and (0,0,0) in a coordinate system in space.

Orthometric Height

The elevation H of a point above or below the geoid.

Parallax

The apparent displacement of the position of a body, with respect to a reference point or system, caused by a shift in the point of observation.

Philadelphia Leveling Rod

Having a target but with graduations so styled that the rod may also be used as a self-reading leveling rod. Also called a Philadelphia rod. If a length greater than 7 feet is needed, the target is clamped at 7 feet and raised by extending the rod. When the target is used, the rod is read by vernier to 0.001 foot. When the rod is used as a self-reading leveling rod, the rod is read to 0.005 foot.

Photogrammetry

Deducing the physical dimensions of objects from measurements on photographs of the objects.

Picture Point

A terrain feature easily identified on an aerial photograph and whose horizontal or vertical position or both have been determined by survey measurements. Picture points are marked on the aerial photographs by the surveyor, and are used by the photomapper.

Planetable

A field device for plotting the lines of a survey directly from observations. It consists essentially of a drawing board mounted on a tripod, with a leveling device designed as part of the board and tripod.

Planimetric Feature

Item detailed on a planimetric map.

Plumb Line

The direction normal to the geopotential field. The continuous curve to which the gradient of gravity is everywhere tangential.

Positional Error

The amount by which the actual location of a cartographic feature fails to agree with the feature's true position.

Post-Processed Real-Time Kinematic GPS

GPS carrier phase positioning performed without real-time data link and solution.

Precision

The amount by which a measurement deviates from its mean.

Prime Meridian

The meridian of longitude 0°, used as the origin for measurement of longitude. The meridian of Greenwich, England, is almost universally used for this purpose.

Prime Vertical

The vertical circle through the east and west points of the horizon. It may be true, magnetic, compass or grid depending upon which east or west points are involved.

Project Control

Control used for a specific project.

Project Datum

Datum used for a specific project.

Projection

A set of functions, or the corresponding geometric constructions, relating points on one surface to points on another surface. A projection requires every point on the first surface to correspond one-to-one to points on the second surface.

Quadrangle

Consisting of four specified points and the lines or line segments on which they lie. The quadrangle and the quadrilateral differ in that the quadrangle is defined by four specified angle points, the quadrilateral by four specified lines or line-segments.

Random Error

Randomly distributed deviations from the mean value.

Range Pole

A simple rod fitted with a sharp-pointed, shoe of steel and usually painted alternately in red and white bands at 1-foot intervals.

Readings

The observed value obtained by noting and/or recording scales.

Real-time

An event or measurement reported or recorded at the same time as the event is occurring through the absence of delay in getting, sending and receiving data.

Real-Time Kinematic GPS

GPS carrier phase processing and positioning in real-time.

Reciprocal Leveling

Measuring vertical angles or making rod readings from two instrument positions for the purpose of compensating for the effects of refraction.

Rectangular Coordinate Systems

Coordinates on any system in which the axes of reference intersect at right angles.

Redundant Measurements

Taking more measurements than are minimally required for a unique solution.

Reference Meridian, True

Based on the astronomical meridian.

Reference Meridian, Magnetic

Based on the magnetic pole.

Reference Point

Used as an origin from which measurements are taken or to which measurements are referred.

Refraction

The bending of rays by the substance through which the rays pass. The amount and direction of bending are determined by its refractive index.

Relative Accuracy

Indicated by the dimensions of the relative confidence ellipse between two points. A quantity expressing the effect of random errors on the location of one point or feature with respect to another.

Repeating Theodolite

Designed so that the sum of successive measurements of an angle can be read directly on the graduated horizontal circle.

Resection

Determining the location of a point by extending lines of known direction to two other known points.

Sexagesimal System

Notation by increments of 60. As the division of the circle into 360°, each degree into 60 minutes, and each minute into 60 seconds.

Set-up

In general, the situation in which a surveying instrument is in position at a point from which observations are made.

Spheroid

Used as a synonym for ellipsoid.

Spirit Level

A closed glass tube (vial) of circular cross section. Its center line forms a circular arc with precise form and filled with ether or liquid of low viscosity, with enough free space left for a bubble of air or gas.

Stadia Constant

The sum of the focal length of a telescope and the distance from the vertical axis of the instrument on which the telescope is mounted to the center of the objective lens-system.

Stadia Traverse

Distances are determined using a stadia rod. A stadia traverse is suited to regions of moderate relief with an adequate network of roads. If done carefully, such a traverse can establish elevations accurate enough for compiling maps with any contour interval now standard.

Standard Error

The standard deviation of the errors associated with physical measurements of an unknown quantity, or statistical estimates of an unknown quantity or of a random variable.

Systematic Error

Errors that affect the position (bias) of the mean. Systematic errors are due to unmodeled affects on the measurements that have a constant or systematic value.

State Plane Coordinate System (SPCS)

A planar reference coordinate system used in the United States.

Strength of Figure

A number relating the precision in positioning with the geometry with which measurements are made.

Subtense Bar

A bar with two marks at a fixed, known distance apart used for determining the horizontal distance from an observer by means of the measuring the angle subtended at the observer between the marks.

Taping

Measuring a distance on the using a surveyor's tape.

Three-wire Leveling

The scale on the leveling rod is read at each of the three lines and the average is used for the final result.

Topographic Map

A map showing the horizontal and vertical locations of the natural and man-made features represented and the projected elevations of the surroundings.

Transformation

Converting a position from one coordinate system to another.

Transit

The apparent passage of a star or other celestial body across a defined line of the celestial sphere.

Transit Rule

The correction to be applied to the departure (or latitude) of any course has the same ratio to the total misclosure in departure (or latitude) as the departure (latitude) of the course has to the arithmetical sum of all the departures (latitudes) in the traverse. The transit rule is often used when it is believed that the misclosure is caused less by errors in the measured angles than by errors in the measured distances.

Transverse Mercator Projection

Mercator map projection calculated for a cylinder with axis in the equatorial plane.

Traverse

A sequence of points along which surveying measurements are made.

Triangulation

Determination of positions in a network by the measurement of angles between stations.

tribrach

The three-armed base, of a surveying instrument, in which the foot screws used in leveling the instrument are placed at the ends of the arms. Also called a leveling base or leveling head.

Trigonometric heighting

The trigonometric determination of differences of elevation from observed vertical angles and measured distances.

Trilateration

Determination of positions in a network by the measurement of distances between stations using the intersection of two or more distances to a point.

Universal Transverse Mercator

A worldwide metric military coordinate system.

US Coast & Geodetic Survey (USC&GS)

Now known as National Ocean Service (NOS).

US Survey Foot

The unit of length defined by 1200/3937 m

Variance-Covariance Matrix

A matrix whose elements along the main diagonal are called the variances of the corresponding variables; the elements off the main diagonal are called the covariances.

Vernier

An auxiliary scale used in reading a primary scale. The total length of a given number of divisions on a vernier is equal to the total length of one more or one less than the same number of divisions on the primary scaled.

VERTCON

Acronym for vertical datum conversion. VERTCON is the computer software that converts orthometric heights between NGVD 29 to NAVD 88.

Vertical Angle

An angle in a vertical plane either in elevation or depression from the horizontal.

Vertical Circle

A graduated scale mounted on an instrument used to measure vertical angles.

Vertical Datum

Any level surface used as a reference for elevations. Although a level surface is not a plane, the vertical datum is frequently referred to as the datum plane.

World Geodetic System of 1984

Adopted as the standard geodetic datum for GPS positioning. Based on the World Geodetic System reference ellipsoid.

Wye Level

Having the telescope and attached spirit level supported in wyes (Y's) in which it can be rotated about its longitudinal axis (collimation axis) and from which it can be lifted and reversed, end for end. Also called a Y-level and wye-type leveling instrument.

Zenith

The point above the instrument where an extension of a plumb (vertical) line at the observer's position intersects the celestial sphere.

Zenith Angle

Measured in a positive direction downwards from the observer's zenith to the observed target.

Zenith Distance

The complement of the altitude, the angular distance from the zenith of the celestial body measured along a vertical circle.